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IV.—*The Arctic Current around Greenland.* By Captain E. IRMINGER of the Danish Navy, Corresponding Member R.G.S.

Communicated by DR. SHAW.

Read, April 28, 1856.

SEVERAL hydrographers* assert that a current from the ocean around Spitzbergen continues its course along the E. coast of Greenland, and thence in a nearly straight line towards the banks of Newfoundland. In this opinion I do not agree, and give my reasons as follows.

Considerable quantities of ice are annually brought with the current from the ocean around Spitzbergen to the S. and S.W. along the E. coast of Greenland,† around Cape Farewell, and into Davis Strait.

These enormous masses of ice are frequently drifted so close to the southern part of the coast of Greenland that navigation through it is impossible. Experience has taught the captains who every year navigate between Copenhagen and the Greenland colonies (which all are situated on the W. side of Greenland) that, on going to these colonies, in order to avoid being beset in the ice, they are obliged to pass a couple of degrees to the southward of Cape Farewell, as well as, after having crossed the meridian of this cape, generally not to steer much to the northward before reaching long. 50° or 52° W. of Greenwich, and sometimes even more westerly. The amount of westing is dependent on the wind, weather, or ice; and by proceeding thus an open sea is reached, either quite free from ice or else with it much more diffused than near the coast, where the ships would be liable to be caught in the drifting masses.

* Kerhallet, Berghaus, and others.

† See Graah, Scoresby, &c., as well as the 'Accounts of the Whalers in the year 1777, by Larens Hansen, Director of the School at Ribe,' in Denmark. These last-mentioned accounts of ten whalers, with their captains, and printed letters from several of these captains to the above-mentioned L. Hansen, give a striking proof of the current and its rapidity from the ocean around Spitzbergen to the S.W. along the E. coast of Greenland. The said ten vessels were enclosed in the ice in June, 1777, in about 76° lat. N., between Spitzbergen and Jan-Mayen island, and were carried, constantly enclosed by the ice, in a south-westerly direction, between Iceland and Greenland, very often in sight of the Greenland coast. By degrees all the vessels were lost, being crushed by the ice; the last vessel on the 11th of October, in 61° lat. N., in sight of Greenland. Of the crews of these vessels, which consisted of about 450 men, only 116 (whose names I have before me) were so fortunate as to save their lives, and get ashore from the ice in the month of October and beginning of November, on the coast around Cape Farewell. By calculating the distance between Cape Farewell and the place where the vessels were enclosed in the ice between Spitzbergen and Jan-Mayen, it gives a distance of about 1400 nautic miles, and the time the ice occupied in drifting from the above-mentioned place to Cape Farewell being about four months, the rapidity of this current has a mean of at least between 11 and 12 nautic miles per 24 hours.

A similar caution is exercised on the homeward passage from the colonies, the course being in the first place off the land, and then in a more southerly direction in order to reach the open sea free from the dangerous ice.

To be enabled to give an idea about the limits of the ice in these regions, I examined a set of logbooks which were kindly given me for perusal from the directors for the "Royal Greenland Commerce," viz., two logbooks for each of the last five years, which gives two outward and two homeward voyages to the colonies every year, consequently in all twenty voyages, which I found sufficient without extending these researches to too great a length.

There are unquestionably great changes in the limits of the ice in different seasons; but still it is probable that the result of these five years' observations will not be far from the mean.

From these logbooks I noted at what latitude the meridian of Cape Farewell had been crossed on the passage to the colonies, and at what place the first ice was seen, and on what latitude the meridian of Cape Farewell was crossed on the homeward passage, and where the last ice was seen.

In the ensuing Table these positions are inserted, and to make the subject still clearer, the places where the first and the last ice was seen are marked in the subjoined Plan.

By examining this Table it will be seen that the meridian of Cape Farewell is crossed on the outward passage in a mean lat. of $57^{\circ} 46'$, and on the homeward passage in $58^{\circ} 2' \text{ N.}$, which gives 123 m. and 107 m. s. of Cape Farewell* respectively as the points where the ocean, according to the logbooks, *has been quite clear of ice*, and where, under ordinary circumstances, a safe passage can be made to avoid the ice, which is usually carried round the coast of Cape Farewell by the current coming from the ocean around Spitzbergen.

On the voyages from the colonies to Copenhagen the course pursued has been somewhat nearer Cape Farewell (16 m.), the cause of which is—1, that the captains, in coming from Davis Strait, have a better knowledge of the situation of the ice, and its distance from the land, than they can have on going up to Greenland in coming from the Atlantic Ocean, where no ice is to be seen; and 2, because the home passages are made in a season in which the ice generally is not quite so abundant as in spring, the season for the voyages to the colonies.

The subjoined Table shows that the brig 'Lucinde' fell in with ice farthest to the E. (4th October, 1851, in $58^{\circ} 30' \text{ N.}$, and $39^{\circ} 30' \text{ W.}$ of Greenwich), which gives 79 nautic m. s., and about

* According to the observations of Captain Graah, Cape Farewell is situated in $59^{\circ} 49' \text{ lat. N.}$, and $43^{\circ} 54' \text{ W.}$ of Greenwich.

Years.	Vessel.	Commander.	Outward Voyage to Greenland.				Homeward Voyage from Greenland.				
			Meridian of Cape Farewell passed.	Date.	First Ice seen.		Meridian of Cape Farewell passed.	Date.	Last Ice seen.		
					Lat. N.	Long. W.			Lat. N.	Long. W.	
1849	Brigantine Neptune .	Knudsen .	0° 58' 0 N.	July 26	0° 58' 10	47° 19	0° 58' 5 N.	Aug. 31	0° 58' 24	44° 35	Aug. 31
—	Barque Julianehaab .	Bohn .	59° 23 ,	May 10	{ Much ice at 26 m. } { S. of C. Farewell }		57° 45 ,	Aug. 31	59° 50	46° 30	Aug. 29
1850	Brig Hvalfisker . .	E. Humble .	58° 8 ,	June 6	59° 50	50° 0	58° 16 ,	Sept. 23	60° 0	47° 20	Sept. 21
—	Brig Egedesminde .	Moberg .	57° 10 ,	May 28	60° 30	52° 10	57° 50 ,	Sept. 28	61° 34	53° 53	Sept. 23
1851	Brig Lucinde . . .	Faltings .	58° 8 ,	April 26	58° 26	50° 9	58° 35 ,	Oct. 2	58° 30	39° 30	Oct. 4
—	Brig Mariane . . .	Dreyer .	57° 30 ,	July 1	57° 55	47° 52	58° 9 ,	Sept. 12	59° 44	46° 46	Sept. 11
1852	Brig Baldur . . .	F. Ocken .	57° 43 ,	April 7	60° 5	52° 30	58° 9 ,	June 9	60° 15	57° 14	May 27
—	Ditto, 2nd voyage .	F. Ocken .	55° 55 ,	Aug. 10	{ Anchored at Godhavn, Aug. 19, } { without seeing any ice on the } { voyage }		56° 36 ,	Oct. 13	60° 45	53° 5	Oct. 3
1853	Brig Baldur . . .	F. Ocken .	57° 56 ,	May 1	63° 50	56° 0	57° 54 ,	June 10	64° 7	54° 18	June 5
—	Brig Pera	Humble .	57° 45 ,	June 23	59° 44	52° 25	58° 58 ,	Sept. 17	60° 40	46° 45	Sept. 16

135 nautic m. E. of Cape Farewell. This ice consisted only of a single isolated floe of very small extent; and it is very rare to meet ice in this latitude so far to the eastward.*

On the passage from Julianehaab to this place very little ice had been in sight.

On these voyages the first and the last seen ice generally consisted of *isolated icebergs or floes*, which, no doubt, formed the *very extremity of the ice* which was coming from the N.E. around Cape Farewell, and going into Davis Strait. Consequently the great and more accumulated masses of ice carried by the current from the ocean around Spitzbergen (whereby this current is really indicated) are *between these above-named outer limits and the coast of Greenland*.

The southerly and south-westerly coasts of Greenland are most exposed to be blocked up with these ice-drifts *in spring*; whilst, on the contrary, they are pretty clear of ice from September to January; but in the end of this month the ice generally begins to come again in great abundance, passing around Cape Farewell. (*Captain Graah*, p. 59.)

Still farther to demonstrate the existence of this ice-drift, I may mention the following extract from the logbook of the schooner 'Activ,' Captain J. Andersen. This vessel belongs to the colony of Julianehaab, and is used as a transport in this district:—

7th of April, 1851, the 'Activ' left Julianehaab, bound to the different establishments on the coast between Julianehaab and Cape Farewell. The same day the captain was forced by the ice to take refuge in a harbour. Frequent snow-storms and frost. On account of icebergs and great masses of floe ice enclosing the coast, it was impossible to proceed on the voyage before the 23rd, when the ice was found to be more open; but after a few hours' sailing the ice again obliged the captain to put into a harbour. Closed in by the ice until the 27th. The ice was now open, and the voyage proceeded until the 1st of May, when the ice compelled him to go into a harbour.

In this month violent storms, snow and frost. From the most elevated points ashore very often no extent of sea visible; now and then the ice open, but not sufficiently so for proceeding on the voyage.

At last, on the 6th of June, in the morning, the voyage was continued; but the same evening the ice enclosed the coast, and

* On the voyage to Greenland in 1828, Captain Graah fell in with the first ice in 58° 52' lat. N., and 41° 25' W. Greenwich, which is only 57' S., and about 77 nautic miles to the eastward of Cape Farewell; and he says, "Since 1817, I do not know that the ice has been seen so far to the eastward of the Cape."—*'Narrative of an Expedition to the East Coast of Greenland, by Capt. W. A. Graah, Royal Danish Navy,'* p. 21, Engl. Transl.

the schooner was brought into "Bliesehullet," a port in the neighbourhood of Cape Farewell.

The following day the voyage was pursued through the openings between the ice; and the 18th of June the schooner arrived again at Julianehaab.

Whilst the masses of ice, as above mentioned, enclosed the coast between Julianehaab and Cape Farewell, the brig 'Lucinde' crossed the meridian of Cape Farewell on the 26th of April, in lat. $58^{\circ} 3' \text{ N.}$ (101 nautic m. from shore), and no ice was seen from the brig before the 2nd of May, in lat. $58^{\circ} 26' \text{ N.}$, and $50^{\circ} 9' \text{ W.}$ of Greenwich.

Further, Captain Knudsen, commanding the 'Neptune,' bound from Copenhagen to Julianehaab, was obliged, on account of falling in with much ice, to put into the harbour of Frederikshaab on the 8th of May, 1852, and was not able to continue his voyage to Julianehaab before the middle of June, because a continuous ice-drift (icebergs as well as very extensive fields) was rapidly carried along the coast to the *northward*.

Captain Knudsen mentions, that during the whole time he was closed in at Frederikshaab he did not a single day discover any clear water even from the elevated points ashore, from which he could see about 28 nautic m. seaward.

Whilst the 'Neptune' was enclosed by the ice at Frederikshaab the brig 'Baldur,' on the home passage from Greenland to Copenhagen (see the foregoing Table), crossed the meridian of Cape Farewell the 9th of June in lat. $58^{\circ} 9' \text{ N.}$ (100 m. from shore) in clear water, and no ice in sight.

From the above it is evident that the current from the ocean around Spitzbergen, running along the E. coast of Greenland past Cape Farewell, continues its course along the western coast of Greenland to the N., and transports in this manner the masses of ice from the ocean around Spitzbergen into Davis Strait.

If the current existed, which the beforenamed writers state to run in a direct line from East Greenland to the banks of Newfoundland, then the ice would likewise be carried with that current from East Greenland; if it were a submarine current, the deeply-immersed icebergs would be transported by it; if it were only a surface-current, the immense extent of field-ice would indicate its course,* and vessels would consequently cross these ice-drifts at

* An observation which it is interesting to mention here, and which gives a proof of the very little difference between the temperature of the surface and that at some depth, is mentioned in the Voyage of Captain Graah, p. 21. He says, "The 5th of May, 1828, in lat. $57^{\circ} 35' \text{ N.}$, and $36^{\circ} 36' \text{ W.}$, Gr., the temperature of the surface was found $6^{\circ} 3$ ($46^{\circ} 2 \text{ Fahr.}$), and at a depth of 660 feet $5^{\circ} 5 + \text{R.}$ ($44^{\circ} 5 \text{ Fahr.}$)." This proves that there is no cold submarine current in the place alluded to to the S.E. of Cape Farewell. A still more conclusive experiment is recorded by Sir Edward Parry in the account of his first voyage, June 13, 1819: in lat. $57^{\circ} 51'$

whatever distance they passed to the southward of Cape Farewell. *But this is not the case*: experience has taught that vessels coming from the eastward, steering their course about 2° (120 nautic m.) to the southward of Cape Farewell, seldom or ever fall in with ice before they have rounded Cape Farewell and got into Davis Strait, *which is a certain proof that there does not exist even a branch of the Arctic current which runs directly from East Greenland towards the banks of Newfoundland.*

Along the E. coast, and around the southern and south-western coast of Greenland, the district of Julianehaab, there is generally a much greater accumulation of ice* than is the case more northerly, on the W. coast, or farther out in Davis Strait, where the ice generally is found more spread, and consequently it frequently happens that vessels bound to Julianehaab from Copenhagen are obliged first to put into some harbour more to the northward, and wait there until the ice is so much dispersed round the S. coast that they can continue their voyage to Julianehaab.

In the warmer season, when the ice and snow melt ashore, the waters from the different fiords or inlets move towards the sea and drive the ice off the coast in such a manner that there is clear water close in shore, through which vessels may be navigated. However, continuing gales, according to their direction to or from shore, have an influence on the situation of the ice.

Another proof that the current from East Greenland does not run in a straight line towards the banks of Newfoundland, is also derived from the observations of the temperature of the surface made on many voyages to and from Greenland. I have noted the observations of two voyages in the subjoined map; one voyage by Captain Graah to Greenland, in May, 1828; and the other by Captain Holböll, from Greenland to Copenhagen, in September, 1844.

Capt. Graah, who during his researches in Greenland passed two summers and one winter on its eastern coast, between Cape Farewell and $65\frac{1}{2}^{\circ}$ lat. N., says that he never found the temperature of the sea here higher than $0^{\circ} \cdot 9 + R.$ (34° Fahr.) †

Supposing that the Arctic current from East Greenland pursued its course in a straight line towards the banks of Newfoundland, it would be crossed, on the voyages from Copenhagen to the Danish colonies in Greenland, between 38° and 45° W. Gr., and so high a temperature in the surface of the ocean as from 4° to 6° R. (41° to $45^{\circ} \cdot 5$ Fahr.), as is found on this route and marked

N., long. $41^{\circ} 5'$, with a very slight southerly current, the surface temperature was $40\frac{1}{2}^{\circ}$ Fahr.; and at 235 fathoms 39° , a difference of only $1\frac{1}{2}^{\circ}$.—ED.

* Captain Graah, pp. 10, 12, 22, 57, &c. English translation.

† Graah says, "The temperature of the sea was frequently observed during the whole voyage, and was always found between 28° and 34° Fahrenheit."

in the plan, would, according to my opinion, be impossible only 1° or 2° to the southward of the parallel of Cape Farewell; as it is a well known fact that the principal ocean-currents maintain their temperatures through very considerable distances of their courses.

This comparatively high temperature of the surface of the ocean so near to the limits of that current which carries enormous masses of ice from the ocean near Spitzbergen round Cape Farewell, warrants my opinion that the waters of the Atlantic Ocean move in a N.-westerly, or northerly direction, towards the eastern and southern coasts of Greenland,* and that this in-draught towards the land is undoubtedly the cause of the ice being so closely pressed on to these parts of the coast as it is so frequently on the S. coast, and almost constantly on the E. coast, rendering the eastern coast entirely inaccessible from seaward.†

The log-books which I have examined afford no positive information as to the direction and force of the current under consideration—a circumstance which must be attributed to the frequency of fogs and gales of wind, which prevent correct observations being made.‡

From the foregoing it seems to me to be demonstrated that the current from the ocean around Spitzbergen, which carries so considerable masses of ice, after it has passed along the E. coast of Greenland, turns westward and northward round Cape Farewell, *without detaching any branch* to the south-westward, directly towards the banks of Newfoundland.

* Graah says in his Narrative (p. 23, English translation),—"In the mouth of Davis Strait I found the temperature of the surface of the ocean from 4° to $3^{\circ}1$ R. (41° to 39° Fahr.), though we were in the proximity of the ice. From this I concluded that a current from the *South* predominated here, because I never before in the vicinity of ice had found the temperature of the water exceeding $1^{\circ}8$ R. (36° Fahr.), and this conclusion was confirmed when, coming to the northward of the ice, I found the temperature of the water $1^{\circ}1 + R.$ ($34^{\circ}5$ Fahr.)"

† Besides the evidence afforded by the ice-drifts and the temperature of the water, as cited by the author, conclusive proof of a northerly set is found in the driftwood which has been so frequently met with around Cape Farewell and off the W. coast of Greenland. A few examples will suffice. A plank of mahogany was drifted to Disco, and formed into a table for the Danish governor at Holstenborg ('Quarterly Review,' No. xxxvi.). Admiral Löwenörn picked up a worm-eaten mahogany log off the S.E. coast of Greenland. These in all probability were transported from the S.W. by the Gulf-stream. Captain Sir Edward Parry, in his second voyage, September 24th, 1823, picked up a piece of yellow pine quite sound, in lat. $60^{\circ}30'$, long. $61^{\circ}30'$ W.; and on his third voyage seven pieces of driftwood were found in the vicinity of Cape Farewell. Again, Captain Sir John Ross found much driftwood around Cape Farewell; and Captain Sir George Back saw in lat. $56^{\circ}50'$, long. $36^{\circ}30'$, a tree with the roots and bark on. These instances might be multiplied, but their character indicates a southern origin.—ED.

‡ Sir John Ross, in his first voyage, May 23, found the current to run 6 m. per day to the W.N.W. in lat. $57^{\circ}2'$ and long. $43^{\circ}21'$ W. (or about 168 m. S. of Cape Farewell), and N.W. when 140 m. S. by W. of the Cape.

Sir Edward Parry, on June 19, 1819, when 130 m. due W. of Cape Farewell, found its direction and velocity to be S. 50° W. 6 m. per diem.—ED.

This current afterwards runs northward along the s.w. coast of Greenland until about lat. 64° N., and at times even up to Holsteinborg, which is in about 67° N.

This current undoubtedly afterwards, by turning to the westward, unites with the current coming from Baffin and Hudson Bays, running to the southward on the western side of Davis Strait along the coast of Labrador, and thus increases that enormous quantity of ice which is brought towards the s. to Newfoundland and further down in the Atlantic Ocean, frequently disturbing and endangering the navigation between Europe and Northern America.

V.—*Memoir on the Map of Damascus, Hauran, and the Lebanon Mountains.* Constructed, from personal survey, by the Rev. J. L. PORTER, A.M., F.R.G.S., and M.R.S.L.

Communicated by JOHN HOGG, Esq., M.A., F.R.S., F.R.G.S.

Read, November 26, 1855.

No section of Syria has hitherto been so much neglected by the geographer as the environs of Damascus. The brief notes, and even the few errors of *Burckhardt* have, since his time, been handed down through each successive generation of authors and cartographers, without alteration or addition. The consequence is, that on all the maps hitherto published, the great plain surrounding the city, though teeming with large villages, is almost a blank, and the few places that are inserted are not in their true positions. The mountain chain of Antilibanus also is distorted and misplaced; the rivers of Damascus are mere fancy sketches, and the *three* lakes, into which they empty their waters, have been thrown into *one* for the sake of unity.

When I began, in the year 1850, to traverse the country, I felt the want of an accurate map; and as business led me frequently to travel up and down the valley of the Barada, the idea occurred to me of delineating its course, at least from its fountain to the city. I immediately commenced a series of observations with a large compass, for which the nature of the district was well adapted. From a little wely that crowns the brow of the ravine through which the river enters the plain, I could see the sublime gorge in the central mountain chain at Sûk; and from a commanding position beside Neby Hâbîl (*Prophet Abel*), at the mouth of this gorge, I saw a conspicuous landmark that showed the position of the great fountain in the plain of Zebdâny. My residence at Bludân afforded many opportunities of noting the features and directions of the mountain chains that encompass this beautiful